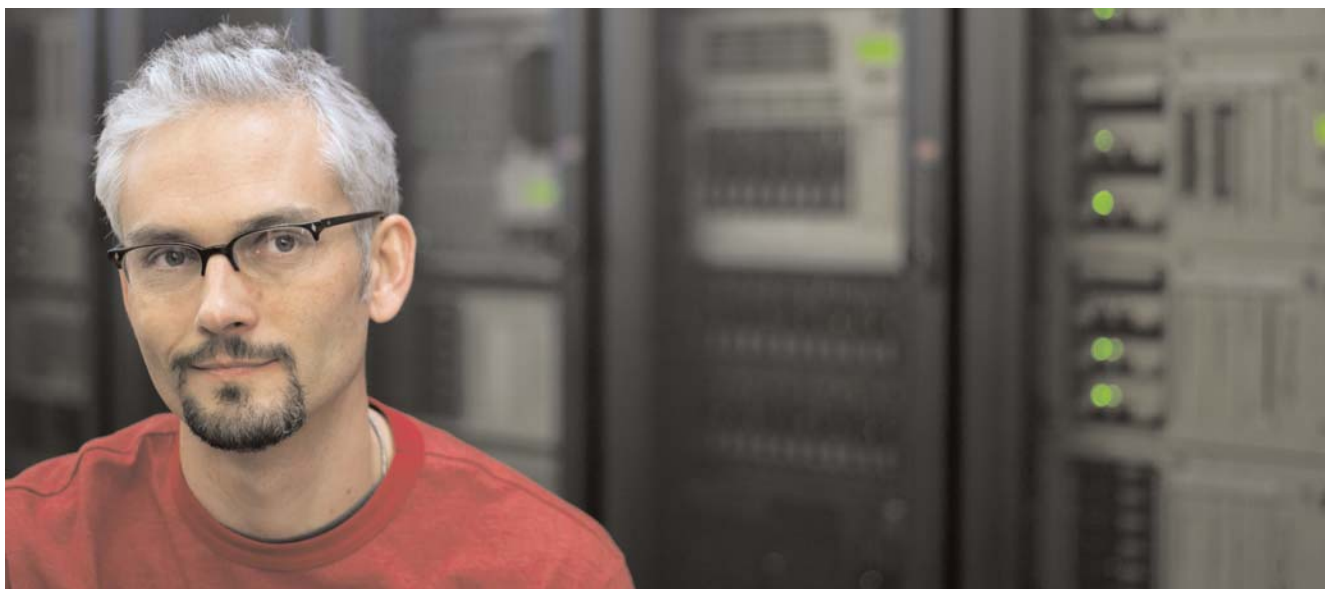


Dual-Core Intel® Xeon® Processor 5100 Series

Driving Energy-efficient Performance in New Dual-Processor Platforms



Intel's newest dual-core processor for dual processor (DP) servers and workstations delivers a new level of energy-efficient performance from the innovative Intel® Core™ microarchitecture, optimized for low-power, dual-core, 64-bit computing.

The 64-bit Dual-Core Intel® Xeon® processor 5100¹ series enables next-generation platforms that can drive energy-efficient infrastructures to optimize data center density, reduce total cost of ownership (TCO), and improve business continuity, redefining what DP servers and workstations should deliver to help businesses be more efficient, dependable, and agile.

The Dual-Core Intel Xeon processor 5100 series is ideal for intense computing environments, 32-bit and 64-bit business-critical applications and high-end workstations. Combined with the Intel® 5000 chipset family and Fully Buffered DIMM (FBDIMM) technology, the new Dual-Core Intel Xeon processor 5100 series-based platforms are expected to deliver up to 3 times the performance and over 3 times the performance/watt of previous-generation single-core Intel® Xeon® processors. The new Dual-Core Intel Xeon processor 5100 series-based platforms are expected to deliver up to 2 times the performance and over 2 times the performance/watt of previous-generation dual-core Intel Xeon processors.²





Intel® Core™ microarchitecture delivers industry-leading performance and helps build energy-efficient infrastructures with Dual-Core Intel® Xeon® Processor 5100 series

New Intel Core microarchitecture is an innovative microarchitecture, enabling you to build industry-leading dual-core performance and performance-per-watt server and workstation platforms for the data center. This new microarchitecture integrates a more efficient pipeline and memory architecture design for greater processor throughput with power management technologies that reduce power consumption without impeding performance.

Platforms based on the Dual-Core Intel Xeon processor 5100 series also support many new Intel® advanced server technologies that help companies enhance operations, reduce costs, and improve business continuity:

- Intel® Virtualization Technology³ provides hardware assistance for software-based virtual environments to support new capabilities, including 64-bit operating systems (OSs) and applications.
- Intel® I/O Acceleration Technology⁴ (Intel I/OAT), hardware- and software-supported I/O acceleration that improves data throughput.

Confidently deliver more services with hardware-assisted virtualization and enhanced reliability in a 64-bit, dual-core platform

The Dual-Core Intel Xeon processor 5100 series matched with Intel advanced server technologies help IT operations deliver more services in the same power envelope and work more efficiently. Enhanced processor reliability, PCI Express* and FBDIMM memory technology reliability features, and virtualization hardware assistance from Intel Virtualization Technology let you confidently build effective virtual environments. Enhanced virtualization and density optimization allow businesses to concentrate more services in less space and fewer systems.

Proven 64-bit computing of the Dual-Core Intel Xeon processor 5100 series gives you additional application headroom, memory flexibility, and increased security. By supporting larger data sets and both 32- and 64-bit applications, new Dual-Core Intel® Xeon® processor-based servers and workstations allow the smooth migration of your business to 64-bit applications. And, with millions of 64-bit processors already shipped, you know you can depend on Intel's proven track record to help you make a smooth transition to the next-generation of computing.



For more information on performance, please visit
www.intel.com/performance/server/xeon

For more information on Intel® Core™ microarchitecture, please visit
www.intel.com/technology/architecture/coremicro

Intel Xeon Processor 5100 Series Overview

Dual processor servers and workstations based on the Dual-Core Intel Xeon processor 5100 series deliver energy-efficient performance, reliability, versatility, and low ownership costs at a variety of price-points.

Features	Benefits
Dual-core processing	▪ Significant performance headroom, especially for multi-threaded applications, helps boost system utilization through virtualization and application responsiveness.
Intel® Core™ microarchitecture	▪ Better performance on multiple application types and user environments at a substantially reduce power envelope.
Majority of SKUs at 65W	▪ Significantly lower power (compared to previous generation) helps improve data center density and power/thermal operating costs.
Ultra-dense, ultra low-power SKUs at 40W	▪ Low-voltage SKU available at reduced power envelopes will deliver even higher performance per watt – helps reduce power/thermal operating costs and improve data center density.
4 MB shared L2 cache	▪ Increases efficiency of L2 cache-to-processor data transfers, maximizing main memory to processor bandwidth and reducing latency. ▪ Entire L2 cache can be allocated to one core.
1066 and 1333 ⁵ MHz system bus	▪ Faster system bus speeds than previous generations for increased throughput.
Intel® Virtualization Technology ³	▪ New processor hardware enhancements that support software-based virtualization, enabling migration of more environments – including 64-bit OSs and applications – to virtual environments.
Intel® Extended Memory 64 Technology (Intel® EM64T) ⁶	▪ Flexibility for 64-bit and 32-bit applications and operating systems.
Demand-Based Switching (DBS) with Enhanced Intel SpeedStep® technology	▪ Helps reduce average system power consumption and potentially improves system acoustics.



What is the 5000 Sequence?

At Intel, our processor series numbers help differentiate processor features beyond front-side bus speed and brand name. New advancements in our processors – other than bus speed – like architecture, cache, power dissipation, and embedded Intel technologies, contribute significantly to performance, power efficiency, and other end-user benefits. Our processor sequences will help developers decide on the best processor for their platform designs, and help end-users understand all the characteristics that contribute to their overall experience.

Intel offers four processor number sequences for server applications

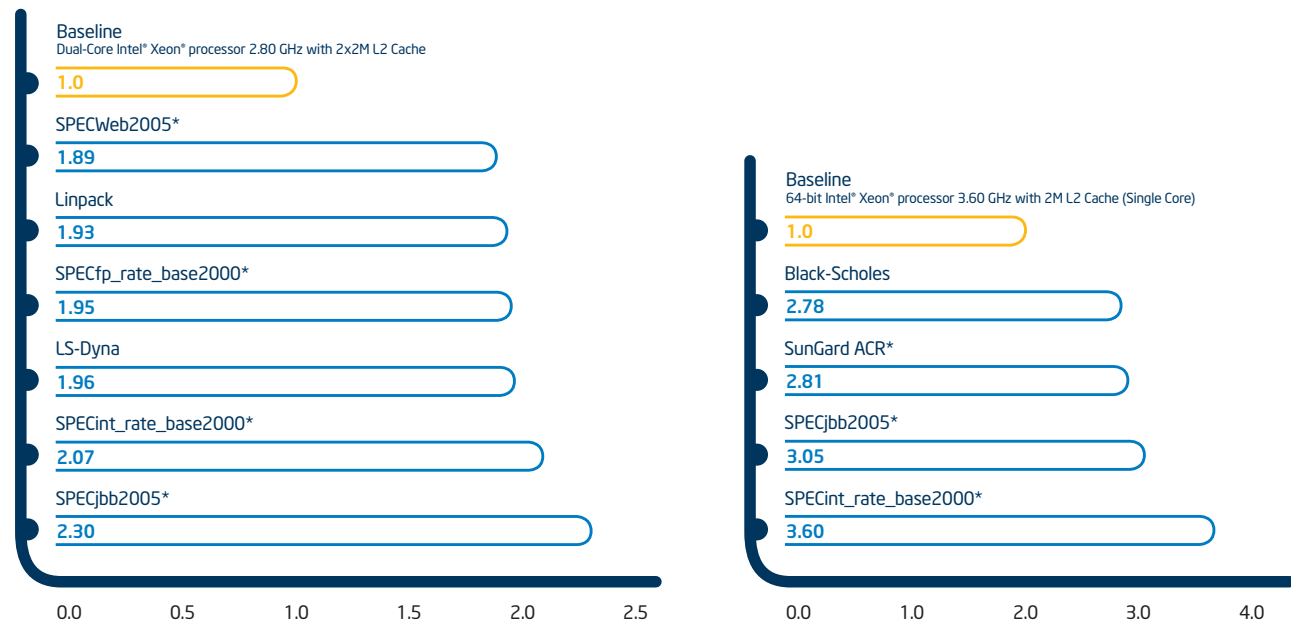
Processor Sequence ¹	Used For
Intel® Pentium® 4/Pentium® D processor	Small business, entry, or first server
Dual-Core Intel® Xeon® processor 5000 sequence	Volume DP servers/workstations based on the Intel Xeon processor
Dual-Core Intel® Xeon® processor 7000 sequence	Greater scalability than DP platforms with MP enterprise servers based on the Intel Xeon processor MP
Intel® Itanium® 2 processor 9000 sequence	Maximum performance and scalability for RISC replacement usage

Dual-Core Intel Xeon processor 5100 series

Processor Number ¹	Speed	Cache Size	Front-Side Bus	Total Dissipated Power	Virtualization Technology ³	Extended Memory 64 Technology ⁶	Demand-Based Switching	Package
Dual-Core Intel® Xeon® processor 5160	3.00 GHz	4M	1333 MHz ⁵	80W	Yes	Yes	Yes	LGA 771
Dual-Core Intel® Xeon® processor 5150	2.66 GHz	4M	1333 MHz	65W	Yes	Yes	Yes	LGA 771
Dual-Core Intel® Xeon® processor LV 5148	2.33 GHz	4M	1333 MHz	40W	Yes	Yes	Yes	LGA 771
Dual-Core Intel® Xeon® processor 5140	2.33 GHz	4M	1333 MHz	65W	Yes	Yes	Yes	LGA 771
Dual-Core Intel® Xeon® processor 5130 ¹	2.00 GHz	4M	1333 MHz	65W	Yes	Yes	No	LGA 771
Dual-Core Intel® Xeon® processor 5120	1.86 GHz	4M	1066 MHz	65W	Yes	Yes	No	LGA 771
Dual-Core Intel® Xeon® processor 5110	1.60 GHz	4M	1066 MHz	65W	Yes	Yes	No	LGA 771

¹Available in boxed version only

Superior Performance and Performance Per Watt with New Dual-Core Intel® Xeon® Processor 5100 Series



Server and HPC Performance

Performance Per Watt Comparison

Benchmarks for Server and HPC Performance

Benchmark Description for SPECWeb*2005: SPECweb2005 evaluates the performance of World Wide Web Servers. SPECweb2005 consists of three separate, distinct workloads Banking, Ecommerce, and Support. The result is the geometric mean of the three submetrics, normalized to a reference platform score.

Configuration Details: Data Source—Published/Submitted results as of May 23, 2006.

Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: Dell PowerEdge® 2850 server platform with Two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache 16 GB DDR2, SUSE Linux® Enterprise Server 9 SP2 (default kernel 2.6.5-7.191-smp) Zeus Web Server* 4.2r4 (x86-64). Referenced as published at <http://www.spec.org/web2005/results/res2005q4/web2005-20051107-00017.html>

Dual-Core Intel Xeon Processor 5160-based platform details: IBM System x3650* Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, 1333 MHz system bus, 24 GB (12x2 GB) FB-DIMM memory, 64-bit Red Hat Enterprise Linux* 4 AS Update 3 operating system, 64-bit Accoria Rock Web Server* 1.3.3 HTTPS software, and Apache Tomcat* 5.5.9. Result submitted to www.spec.org for review at 9182 as of May 23, 2006.

Benchmark Description for Linpack: Linpack is a floating-point benchmark that solves a dense system of linear equations in parallel. The metric produced is Giga-FLOPS or billions of floating point operations per second. The benchmark is used to determine the world's fastest computers at the website <http://www.top500.org/>

Configuration Details: Data Source: Published/Measured results as of May 19, 2006.

Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: Intel preproduction software development platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache and 800 MHz system bus and 8 GB (8x1024 MB) DDR2-400 memory; Red Hat Enterprise Linux* 3, Update 3, Intel® EM64T, Intel Linpack 2.1.2

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction customer reference board with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory; Red Hat Enterprise Linux* 4, Update 2, Intel® EM64T, Intel Linpack 3.0.1

Benchmark Description for SPECfp*_rate_base2000: SPECfp*_rate_base2000 is a compute-intensive benchmark that measures the floating point throughput performance of a computer system carrying out a number of parallel tasks.

Configuration Details for SPECfp*_rate_base2000: Data Source—Published/Submitted results as of May 23, 2006.

Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: FSC Primergy RX300* S2 Server platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache 800 MHz system bus, 4 GB DDR2, 64-Bit Red Hat Enterprise Linux* AS release 4 update 1 Kernel 2.6.9-1.1.ELsmp on an x86_64 Intel C++ and Fortran Compiler 9.0 for Intel® EM64T Build 20050914 (for 64-bit applications). Referenced as published at 425. For more information see <http://www.spec.org/cpu2000/results/res2005q4/cpu2000-20051004-04899.html>

Dual-Core Intel Xeon Processor 5160-based platform details: Dell PowerEdge® 2950 Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, 1333 MHz system bus, 8GB (8x1GB) FB-DIMM memory, Red Hat Enterprise Linux* 4 Advanced Server Update 3 Intel® EM64T. SPEC binaries built with Intel C/C++ Compiler 9.0. Result submitted to www.spec.org for review at 83 as of May 23, 2006.

Benchmark Description for LS-DYNA: LS-DYNA is a commercial engineering application used in finite element analysis such as a car collision. The workload used in these comparisons is called 3 Vehicle Collision.

Configuration Details: Data Source—Published/Measured results as of May 19, 2006.

Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: Intel preproduction software development platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache and 800 MHz system bus and 8 GB (8x1024 MB) DDR2-400 memory; Red Hat Enterprise Linux* 3, Update 3, Intel® EM64T, LS-DYNA mpp970.5434a*

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction customer reference board with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory; Red Hat Enterprise Linux* 4, Update 2, Intel® EM64T, LS-DYNA mpp970.5434a*. Result Submitted to www.topcrunch.org as of 5/23/06.

Benchmark Description for SPECint*_rate_base2000: SPECint*_rate_base2000 is a compute-intensive benchmark that measures the integer throughput performance of a computer system carrying out a number of parallel tasks.

Configuration Details: Data Source—Published/Submitted results as of May 23, 2006.

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Platform Solutions

The following chipsets are optimized for the Dual-Core Intel Xeon Processor 5100 series. Compared to previous-generation chipsets, they deliver higher throughput with dual independent buses, faster memory and I/O bandwidth, and FBDIMM support. In addition, support for Intel® Active Server Manager⁷ and Intel I/OAT help improve overall system performance and manageability.

DP server-supported chipsets

Two chipset versions enable server configuration flexibility for unique business needs and market segments.

- **Intel® 5000P chipset:** For performance and volume server platforms, this chipset supports dual independent buses for dual-processor applications, 1066 and 1333⁵ MHz system bus speeds, three PCI Express* x8 links (each configurable as two x4 links), FBDIMM 533 and 667 technology, point-to-point connection for Intel® 6321 ESB I/O Controller Hub at 2 GB/s, and Intel® 6700PXH 64-bit PCI hub.
- **Intel® 5000V chipset:** For value platforms, this chipset supports dual independent buses for dual-processor applications, 1066 and 1333 MHz system bus speeds, one PCI Express x8 link (configurable as two x4 links), FBDIMM 533 and 667 technology, point-to-point connection for Intel 6321 ESB I/O Controller Hub at 2 GB/s, and Intel 6700PXH 64-bit PCI hub.

DP workstation-supported chipset

DP workstations based on the Dual-Core Intel Xeon processor 5100 series are ideal for today's demanding applications in computer aided engineering (CAE), electronic design automation (EDA), digital media, financial analysis, oil and gas exploration, and software engineering. With its large 4M cache size, Dual-Core Intel Xeon processor 5100 series-based workstations provide superior performance for multi-threaded applications.

- **Intel® 5000X chipset:** For performance and volume workstation platforms, this chipset supports dual independent buses for dual-processor applications, 1066 and 1333 MHz system bus speeds, one PCI Express x8 link (configurable as two x4 links) and one configurable x16 link for graphics support, FBDIMM 533 and 667 technology, point-to-point connection for Intel 6321 ESB I/O Controller Hub at 2 GB/s, and Intel 6700PXH 64-bit PCI hub.

These platform configurations provide flexibility and headroom for future growth in high-end workstations and front-end, small/medium business, enterprise, and high-performance computing (HPC) server deployments, allowing right-sized solutions for today's environments while helping to protect investment in design, integration, and support.

Find out more about Dual-Core Intel® Xeon® processors at www.intel.com/server



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Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: IBM eServer xSeries* 346 Server platform with two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 Cache and 800 MHz system bus 8 GB (8x1 GB) DDR2 memory, Microsoft Windows Server* 2003, standard Edition. SPEC binaries built with Intel C/C++ Compiler 9.0. Referenced as published at 59.5. For more information see <http://www.spec.org/cpu2000/results/res2005q4/cpu2000-20051006-04904.html>

Dual-Core Intel Xeon Processor 5160-based platform details: Dell PowerEdge* 2950 Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, 1333 MHz system bus, 8GB (8x1GB) FB-DIMM memory, Microsoft Windows Server* 2003. SPEC binaries built with Intel C/C++ Compiler 9.1. Result submitted to www.spec.org for review at 123 as of May 23, 2006.

Benchmark Description for SPECjbb*2005: SPEC Java Business Benchmark 2005 (jbb2005). Written in Java, this multi-threaded benchmark emulates an order processing environment in a company with multiple warehouses serving multiple customers. Measures average transaction throughput of a heavily loaded server. Performance reported in Business Operations per Second (BOPS).

Configuration Details: Data Source—Published/Submitted results as of May 23, 2006.

Dual-Core Intel Xeon Processor 2.80 GHz-based platform details: Fujitsu Siemens Computers PRIMERGY* RX300 S2 server platform: Two Dual-Core Intel® Xeon® processors 2.80 GHz with 2x2 MB L2 cache 800 MHz system bus, 4 GB DDR2, Microsoft Windows Server* 2003. Java HotSpot* Server VM (build 1.5.0_06-b05). Referenced as published at 41986 bops and 41986 bops/jvm For more information see <http://www.spec.org/jbb2005/results/res2005q4/jbb2005-20051206-00040.html>

Dual-Core Intel Xeon Processor 5160-based platform details: Fujitsu Siemens PRIMERGY* RX200 S3 Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, 1333 MHz system bus, 8 GB (8x1 GB) FB-DIMM memory, Windows 2003 Enterprise Edition*. BEA JRockit* 5.0 P26.4.0. Result submitted to www.spec.org for review at 96404 bops and 96404 bops/jvm as of May 21, 2006.

Benchmarks for Performance Per Watt Comparison

Benchmark Description for Black-Scholes: The Black-Scholes kernel workload is based on a financial modeling algorithm for the pricing of European-style options. The benchmark consists of a kernel that implements a derivative of the Black and Scholes technique.

Configuration Details: Data Source—Results published by Principled Technologies at http://www.principledtechnologies.com/clients/reports/Intel/WBlack_Scholes_0506.pdf as of May 23, 2006.

Intel Xeon Processor 3.60 GHz-based platform details: Intel preproduction Server platform with two 64-bit Intel® Xeon® processors 3.60 GHz with 2 MB L2 Cache and 800 MHz system bus and 8 GB (8x1024 MB) DDR2-400 memory, Microsoft Windows Server* x32 Enterprise Edition. Black-Scholes 64-bit version kernel workload.

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory, Microsoft Windows Server* x32 Enterprise Edition. Black-Scholes 64-bit version kernel workload.

Benchmark Description for SunGard: SunGard ACR* is a financial services application. This workload analyzes a large portfolio of client assets and generates a credit risk evaluation.

Configuration Details: Data Source: Results published by Principled Technologies at http://www.principledtechnologies.com/clients/reports/Intel/WSunGard_ACR_0506.pdf as of May 23, 2006.

Intel Xeon Processor 3.60 GHz-based platform details: Intel preproduction Server platform with two 64-bit Intel® Xeon® processors 3.60 GHz with 2 MB L2 Cache and 800 MHz system bus and 8 GB (8x1024 MB) DDR2-400 memory, Microsoft Windows Server* x32 Enterprise Edition. SunGard Adaptiv* Credit Risk 64-bit version workload.

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory, Microsoft Windows Server* x32 Enterprise Edition. SunGard Adaptiv* Credit Risk 64-bit version workload.

Configuration Details for SPECjbb2005*: Data Source—Results published by Principled Technologies at http://www.principledtechnologies.com/clients/reports/Intel/WSPECjbb2005_0506.pdf as of May 23, 2006.

Intel Xeon Processor 3.60 GHz-based platform details: Intel preproduction Server platform with two 64-bit Intel® Xeon® processors 3.60 GHz with 2 MB L2 Cache and 800 MHz system bus and 8 GB (8x1024 MB) DDR2-400 memory, Microsoft Windows Server* x32 Enterprise Edition. BEA JRockit* 5.0 P26.0.0.

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory, Microsoft Windows Server* x32 Enterprise Edition. BEA JRockit* 5.0 P26.0.0.

Configuration Details for SPECint_rate_base2000: Data Source—Results published by Principled Technologies at http://www.principledtechnologies.com/clients/reports/Intel/WSPECint_rate_0506.pdf as of May 23, 2006.

Intel Xeon Processor 3.60 GHz-based platform details: Intel preproduction Server platform with two 64-bit Intel® Xeon® processors 3.60 GHz with 2MB L2 Cache and 800 MHz system bus and 8GB (8x1024 MB) DDR2-400 memory, Microsoft Windows Server* x32 Enterprise Edition. SPEC binaries build with Intel compiler 9.0.

Dual-Core Intel Xeon Processor 5160-based platform details: Intel preproduction Server platform with two Dual-Core Intel Xeon Processor 5160, 3.00 GHz with 4 MB L2 Cache, dual 1333 MHz system bus, 8 GB (8x1 GB) 667 MHz FB-DIMM memory, Microsoft Windows Server* x32 Enterprise Edition. SPEC binaries build with Intel compiler 9.0.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference http://www.intel.com/performance/resources/benchmark_limitations.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms and assigning them a relative performance number that correlates with the performance improvements reported.

¹ Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor series, not across different processor sequences. See http://www.intel.com/products/processor_number for details.

² Source: Intel Internal Measurement, May 2006. For more information about server or workstation performance, visit www.intel.com/performance/server or www.intel.com/performance/workstation.

³ Intel Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.

⁴ Intel® I/O Acceleration Technology (Intel® I/OAT) requires an operating system that supports Intel I/OAT.

⁵ Available 2H 2006.

⁶ 64-bit Intel® Xeon® processors with Intel® EM64T requires a computer system with a processor, chipset, BIOS, OS, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel EM64T-enabled OS, BIOS, device drivers and applications may not be available. Check with your vendor for more information.

⁷ Intel® Active Server Manager requires the computer to have additional hardware and software, connection with a power source, and a network connection. Check with your PC manufacturer for details.

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